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A NEW SPECIES AND A NEW VARIETY OF PHILIPPINE ANOPHELES RELATED TO ANOPHELES LEUCOSPHYRUS DÖNITZ.[1]

By W. V. KING,

Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture,

AND

F. E. BAISAS, *Philippine Health Service.*

The first specimens of a new species of *Anopheles* belonging to the *leucosphyrus* subgroup were collected in 1930 on the Island of Mindanao by D. Santiago. Two years later, on a collecting trip arranged by the senior author, a larger series of the new species and specimens of a new variety of *A. leucosphyrus* Dönitz were obtained in the same locality by the junior author.

The adults of the two new forms are similar in appearance and are distinguished principally by the absence of a prehumeral white spot on the costa in *A. cristatus*, sp. n. The larvae, however, are quite distinct, that of *A. cristatus* having large, conspicuously branched postclypeal hairs, separating this species at once from the other members of the series and, in fact, from all the Philippine *Myzomyia*. The larval characters of *A. leucosphyrus riparis*, var. n., are similar to those described for the type form. The adult is distinguished from the type form by the presence of a dark stripe on the white band of the hind tibia, by reduced palpal and tarsal banding, and by other differences noted in the descriptions.

The *leucosphyrus* subgroup, or series, is characterized by the presence of a conspicuous white band on the apical part of the hind tibia and base of the first hind-tarsal segment. The subgroup belongs to group *Neomyzomyia*, in which the palpi have four or more pale bands, the wings usually with multiple dark spots on some of the veins (more than three on vein 6) the legs usually speckled, propleural hairs present, and pronotal lobes usually with scale tufts. In the larval stage the inner clypeal hairs are widely separated and none of the pleural hairs are feathered.

[1] The studies on which this paper is based were carried out under the auspices of the International Health Division of the Rockefeller Foundation, in coopera-

Anopheles (Myzomyia) cristatus, sp. n.

Female.—Antennae with a few white scales on the first flagellar segment. Palpi of type specimen somewhat shrunken and distorted, but in other specimens as long as the proboscis or nearly so; palpal segments mostly covered with dark scales, which are long and semierect toward base; four pale bands, one each at the apex of segments 2, 3, 4, and 5. Segment 5 is usually merely tipped with pale scales, and the preceding bands are usually very narrow; one specimen, however, has the apical segment divided into nearly equal lengths of black and pale scales, and another has the distal two-thirds white.

Anterior pronotal (prothoracic) lobes small, with a small tuft of broad, dark scales; propleural (prosternal) hairs single on each side; other lateral thoracic hairs not distinct on the type specimen but in other specimens consisting of 1 or 2 spiracular hairs (very small and pale), 2 to 4 pre-alar hairs, 2 or 3 upper and 1 or 2 lower sternopleural hairs, and 3 to 5 upper mesepimeral hairs. Mesonotum with sparse, yellowish hairlike scales, broader white ones in front, centrally and laterally, and darker broad ones lower down on the anterior promontory.

Wing (Plate 4, *A*) 3.0 mm., with contrasting cream and black scaling; multiple spots on some of the veins, as in *leucosphyrus*, the number varying from 4 to 7 on vein 6 (*An*). Costa usually with a spot of pale scales over the humeral cross vein; prehumeral pale spot usually absent (14 of 16 specimens), a small interruption occurring on one wing of one specimen and a few pale scales at this point on another. Presector dark spot of vein 1 (R_1) about equal in length to that on costa and subcosta, not interrupted with white. An accessory sector spot constantly present on subcosta and vein 1 and frequently on costa; on vein 1 this spot often continuous with sector spot. Subapical dark spot of vein 1 usually having one white interruption, but sometimes entirely dark; basal end even with that of the corresponding spot on costa. Vein 2 (R_{2+3}) with a comparatively large dark spot basally and a small one at the fork, this vein appearing to start as a branch of vein 1, instead of having the more usual nearly right-angled cross-vein connection.[2] Wing fringe with a pale spot at the tip of 5.2 (Cu_2) in half the specimens, but fringe spots lacking between 5.2 and 6 and at the tip of the latter. Other wing markings as shown in the illustration, some slight variations occurring in the number of spots on the longitudinal veins.

Legs well speckled with yellowish scales; front femora pale ventrally on apical half. First tarsal segment of fore legs well speckled; small apical and basal white bands at tarsal joints 1–2, 2–3, and 3–4; last tarsal and apical part of fourth segment dark. Mid-tarsi unbanded and with only the merest indi-

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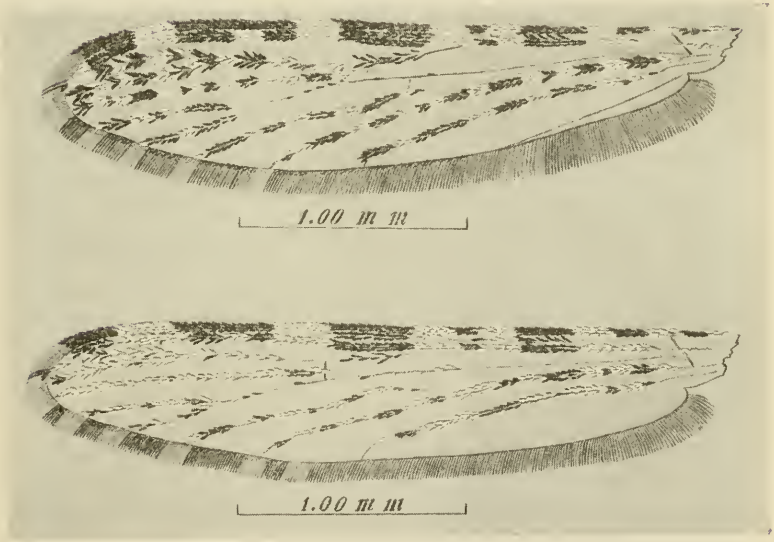
tion with the Philippine Health Service, the Philippine Bureau of Science, and the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The specimen material of the two new forms has been on hand for some time, but their description has been delayed pending an opportunity on the part of the senior author, who has in the meantime returned to the United States, to complete a comparative study of related forms.

[2] This rather interesting deviation also occurs in *A. kochi*, *A. leucosphyrus* and *A. kolambuganensis* (but not in *A. tessellatus* or *A. karwari*) and is correlated with an accessory sector spot that tends to involve the costal vein.

A



B

A, Wing of type female of *Anopheles cristatus*.

B, Wings of type female (upper) and allotype male (lower) of *Anopheles leucosphyrus* var. *riparis*.

cation of paler scales at the apex of some of the segments; first tarsal segment unspeckled or with 1 to 4 scattered spots. Hind tibia with a prominent pale area apically, one-fifth to one-fourth the length of the segment dorsally and laterally but much shorter ventrally, owing to a streak of dark scales extending nearly to the joint; first hind-tarsal segment with a basal continuation of the tibial band; first and second hind-tarsal segments with scattered speckling; tarsal segments 1, 2, 3, and 4 tipped with pale scales, the spots on 1 and 4 usually not conspicuous.

Abdomen black and devoid of scales except for a fringe of yellowish ones on segment 8 and on the cerci.

Male.—Similar in general to female. Palpal club pale except for a dark band at the base and a narrow one (sometimes incomplete) centrally; preceding segment with a wide apical white band and a dorsal spot or streak of white scales, of varying size, centrally; junction of segments 2 and 3 bare of scales, with pale chitin showing; segment 2 (first long segment) with a patch of white scales centrally or basally.

Propleural hairs of thorax single.

Wing with dark areas somewhat reduced; prehumeral pale spot of costa absent in all except one specimen, in which a small interruption occurs; presector dark spot of vein 1 not interrupted with white and of length about equal to that on costa; accessory sector spot present on costa, subcosta, and vein 1 (lacking on only one costa), sometimes, especially on vein 1, continuous with sector spot. Fringe spot at tip of vein 5.2 present in 7 of 10 specimens.

Coxite (side piece) of terminalia with a group of 4 parabasal spines, 1 separated from others. Harpago (claspette) with a fused club, an apical hair of about same length as club and 1 somewhat shorter hair internally arising near base of apical hair. (Pl. 5, *c*) Phallosome (mesosome) with 5 to 9 delicate leaflets on each side, some of which have 2 to 4 small serrations on one edge basally or centrally; length of longest leaflets 0.030 to 0.035 mm. (Pl. 5, *a*.)

Larva.[3]—Inner anterior clypeal hairs widely separated at base and with distinct side branches on basal half; outer clypeal hairs somewhat more than half length of inner, with several stout branches; postclypeal hairs as long as outer and conspicuously branched, bases intermediate between those of inner and outer hairs. (Pl. 5, *e*.)

Inner occipital hair usually simple or forked, occasionally 3-branched; outer occipitals usually forked, sometimes 3-branched or simple. Inner anterior thoracic, or shoulder, hair (no. 1 of prothorax) with 9 to 20 branches, usually 12 to 18; median hair (no. 2) with 7 to 17 branches, usually 12 to 16. Basal tubercles of these hairs not fused.

Ventral pleural hair group of prothorax with 3 long, simple hairs, 1 of which may be forked; pleural hair groups of meso- and meta-thorax each with the 2 long hairs simple.

Thoracic palmate hair (Pl. 5, *f*) with 6 to 12 leaflets, somewhat broadened

[3] Illustrations of some of the larval characters for this species have been published, under the designation of "near-*leucosphyrus*," by Russell and Baisas (Philip. Jour. Sci. 55 : 307–336, illus. 1934), and only certain ones are included here for convenient comparison.

and tapering to a sharp point or slender filament. Palmate hair of first abdominal segment with 1 to 5 leaflets, undeveloped or only slightly broadened. Palmate hair of second abdominal segment (Pl. 5, *g*) with 11 to 24 leaflets, somewhat smaller than those on succeeding segments but well developed and with differentiated filaments; leaflets of palmate hairs on remaining segments long and fairly narrow, notched at outer one-fourth, and tapering to a fine point.

Lateral abdominal hairs of segments 4 to 6 with from 2 to 5 branches but usually with 3, branching occurring at about one-fourth to one-third of distance from base. Prepalmate hair (no. 2) with 3 to 6 branches on segment 2, 2 to 5 branches on segment 3, 1 to 3 branches (usually 2) on segments 4 and 5, 2 or 3 on segment 6 (no. 3 on this segment), and 2 to 4 on segment 7. Pecten of eighth segment (Pl. 5, *h*) with 10 or 11 teeth, most of which are of approximately equal length and serrated on basal half.

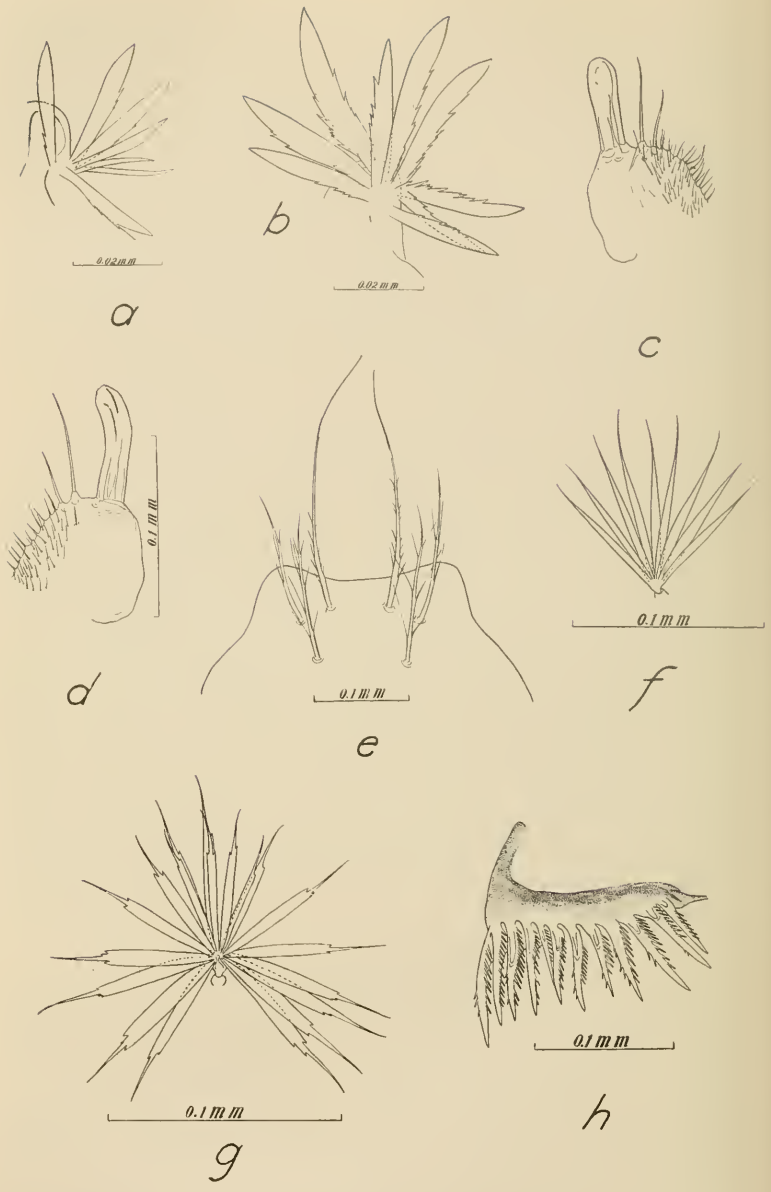
Types.—Type female, specimen no. 358–2, reared from larva collected by F. E. Baisas on March 30, 1932, at Titunod, Kolambugan, Lanao Province, Mindanao, P. I. Allotype male, no. 350–9, collected as larva in the same locality on March 23. The type specimens, with slide mounts of larval and pupal skins, are to be deposited in the United States National Museum. The entire series consists of 17 males and 16 females, of which 3 males and 2 females were collected in the vicinity of Kolambugan by D. Santiago in December, 1930, the remainder in the same locality by the junior author in March and April, 1932. The larval material consists of about 50 skins or whole larvae.

Breeding places.—The larvae of *Anopheles cristatus* were found by Mr. Baisas only in holes in the rock formation in the bed of a small stream, a branch of the Tinae Manoc. Most of these rock holes were only a few inches in diameter. The larvae are black and prefer holes in the dense shade of overhanging bushes. Some of the larvae of *leucosphyrus* variety *riparis* were found in larger rock holes in the same area, but we have no record of the two species having been taken from the same hole.

Anopheles (Myzomyia) leucosphyrus variety **riparis,** var. n.

A series of adult specimens reared from larvae obtained in the vicinity of Kolambugan, Island of Mindanao, differ sufficiently from the type form of *leucosphyrus* and its variety *hackeri* to warrant their separation as a distinct geographical variety. The specimen material at hand of the Mindanao form consists of 17 males, 30 females, and about 65 larval skins or whole larvae.

Female.—Palpal bands very narrow and the apex merely tipped with white in most of the specimens, the bands occasionally somewhat wider or, as an extreme variation (in two specimens), segments 4 and 5 largely white-scaled;



PARTS OF MALE TERMINALIA.

Anopheles cristatus, *a*, leaflets of phallosome, *c*, harpago;
Anopheles leucosphyrus var. *riparis*, *b*, leaflets of phallosome, *d*, harpago.
Anopheles cristatus, *e*, clypeal hairs; *f*, thoracic palmate hair; *g*, palmate hair of second abdominal segment; *h*, pecten of eighth segment.

length of palpi equal or nearly equal to that of proboscis, at least reaching base of labella. Propleural thoracic hairs single. Wing (Pl. 4, *B*, upper) with prehumeral and humeral pale costal spots on all specimens; presector dark spot of vein 1 no longer than that on costa, uninterrupted with white; accessory sector spot usually extending onto costa; subapical dark spot of vein 1 with one white interruption or, if continuously dark, slightly shortened at basal end, otherwise of about same length as corresponding spot on costa. Tarsal apical white bands small and inconspicuous on hind legs, and basal band lacking on segment 4; mid-tarsi unbanded or with a mere indication of pale scales; front tarsal bands narrow. Femur, tibia, and first tarsal segments well speckled; average number of spots on first mid-tarsal about 6, with a range up to 15. Apical tibial band long except in front, where dark scales extend nearly to tip, as in *cristatus*.

Male.—Wing markings (Pl. 4, *B*, lower) and tarsal bands similar in general to those of female. Scaling of club similar to that of *cristatus*. Propleural hairs single, except for one specimen which has 2 hairs on one side. Coxite of terminalia with a group of 4 parabasal spines, 1 somewhat separated from the remainder of the group. Phallosome with 6 to 9 leaflets (Pl. 5, *b*) on each side; some of the leaflets rather coarsely serrated, the long one on both edges; length of longest leaflet 0.035–0.040 mm. Harpago (Pl. 5, *d*) with apical hair about as long as club and with one internal hair about half as long.

Larva.—Inner clypeal hairs sparsely frayed, outer hairs usually simple, seldom forked, and half or less than half length of inner; postclypeal hairs short, usually simple, sometimes 2- to 5-branched. (Fig. 1, *a*.) Inner occipital hair usually simple but may have 2 to 5 branches; outer occipital hair with from 2 to 7 branches. Anterior thoracic (shoulder) hairs well branched, inner with an average of 16 branches, middle with an average of 13; basal tubercles may or may not be fused. Ventral pleural hairs of thorax not feathered. Thoracic palmate hair (Fig. 1, *b*) and those of abdominal segments 1 and 2 (Fig. 1, *c*) undeveloped. Lateral abdominal hairs usually 2-branched on segments 4 and 5 and 3-branched on segment 6, but with a variation of 1 or 2 branches; hairs branched near base as a rule. Pecten of eighth segment (Fig. 1, *d*) with short teeth half or less than half length of long ones; teeth serrated on basal half.

Types.—Type female, no. 382–8, reared from larva collected on April 22, 1932, in vicinity of Kolambugan, Lanao Province, Mindanao, P. I. Allotype male, no. 365–2, collected as larva (at Titunod) on April 6, 1932. Type specimens, with slide mounts of larval skins, to be deposited in the United States National Museum.

Breeding places.—Larvae were first taken in rock holes in locations similar to those noted for *cristatus*. They were obtained later in considerable numbers in other types of pools left in stream beds by receding water or between boulders at the edge of the stream. The larvae are light in color in contrast to the black larvae of *cristatus*.

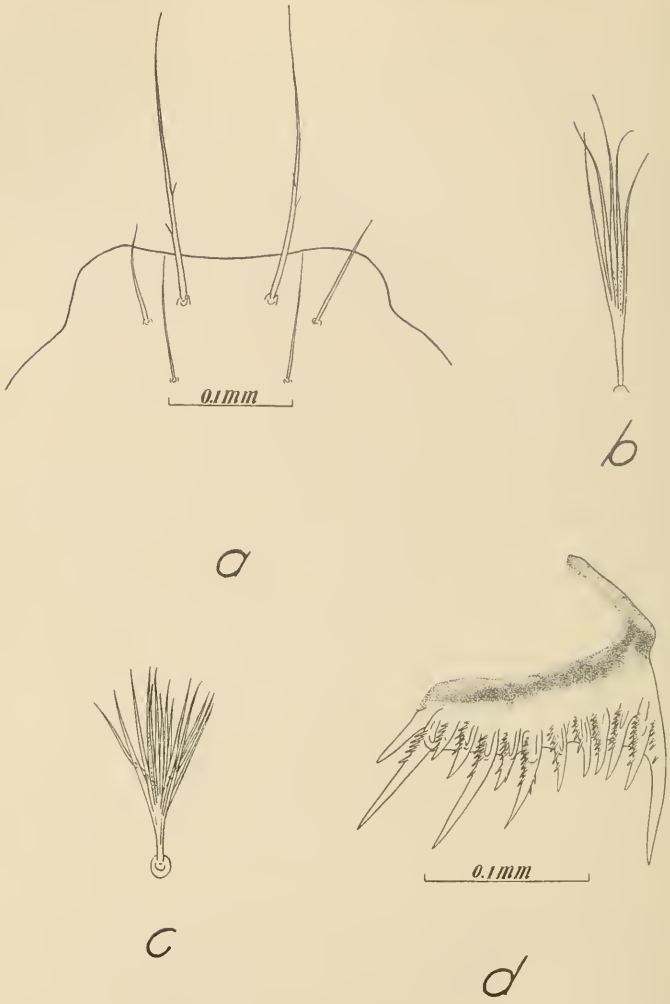


FIG. 1.—*Anopheles leucosphyrus* var. *riparis*, *a*, clypeal hairs; *b*, thoracic palmate hairs; *c*, palmate hair of second abdominal segment; *d*, pecten of eighth segment.

COMPARISON OF SPECIES AND VARIETIES.

Variety *riparis* differs from the type form of *leucosphyrus* in having a stripe of dark scales on the frontal aspect of the apical tibial band, in the narrower bands of the two apical palpal segments, in the reduced tarsal banding, and probably in the scaling of the presector and subapical dark spots on wing

vein 1. The presector dark spot is no longer than that on the costa and is uninterrupted with white scaling. The subapical dark spot has only one white interruption, and occasionally none. Several specimens of *leucosphyrus* from the Island of Luzon have a longer presector dark spot on the first vein, extending to the middle of the presector white spot or farther, and with 1 to 3 white interruptions. The subapical dark spot has 2 to 4 white interruptions, and the base usually extends into the area of the subcostal white spot. Two specimens at hand, labeled "*A. leucosphyrus*, Borneo" (received through the kindness of Dr. R. Soesilo), and also the wing of *leucosphyrus* as illustrated by Christophers[4] show markings similar to the Luzon material in these respects. The portions of legs remaining on the Borneo specimens have conspicuous tarsal bands, with a basal spot on segment 4 and a pale tip on segment 5 of the hind tarsi. The two forms may also differ in the number of thoracic propleural hairs of the male. One male at hand labeled "*A. leucosphyrus*, Malaria Bureau F. M. S.," and 2 of 3 males at hand from Luzon, P. I., have double hairs on each side; the third Luzon specimen has 2 on one side but apparently only 1 on the other. Single hairs are present on each side in 16 of the 17 males from Mindanao, the other specimen having 2 hairs on one side and 1 on the other.

From the published descriptions, the adult of *A. leucosphyrus* var. *hackeri* Edwards differs from variety *riparis* in the shorter palpi and probably in the absence of dark scaling on the apical tibial band. The illustration of the larva of variety *hackeri* given by Gater[5] shows the clypeal hairs all simple, with the outer and posterior ones unusually long. This author also states that the palmate hair of abdominal segment 2 is fully developed.

Workers in the Netherlands East Indies do not distinguish larvae of variety *hackeri* from those of *leucosphyrus*, and it is presumed that these larvae have branched inner clypeal hairs and a rudimentary palmate hair on segment 2. If the identifications of variety *hackeri* for this region have been based mainly on the difference in the palpal bands rather than on the comparative length of the palpi (the published keys give the former as the first point of distinction), it seems probable that their form is more closely related to variety *riparis*. The distribution given by Swellengrebel and Rodenwaldt[6] for variety *hackeri* is more within the general region of Mindanao

[4] Christophers, S. R. Fauna of British India. Diptera, v. 4. Family Culicidae, Tribe Anophelini, p. 178. London (1933).

[5] Gater, B. A. R. Aids to the Identification of Anopheline Larvae in Malaya, p. 119. Singapore (1934).

[6] Swellengrebel, N. H., and Rodenwaldt, E. Die Anophelen von Niederländisch-Ostindien, p. 197. Jena (1932).

than of the Malay Peninsula, which is the type locality of *hackeri*.

The adults of variety *riparis* resemble those of *cristatus* more closely than any of the other forms, the principal point of distinction being the presence of a prehumeral pale spot in the former. As previously indicated, however, the larvae are distinct, especially in the branching of the clypeal hairs and in the development of the second abdominal palmate hair.

Anopheles incognitus Brug., a species described from a single larval specimen from Dutch New Guinea, appears to have postclypeal hairs similar to those of *cristatus*. The inner anterior thoracic hairs as described, however, are much smaller and with fewer branches. Swellengrebel and Rodenwaldt[7] place the species provisionally near the groups *Neocellia* and *Cellia* on the basis of a feathered long hair in each of the thoracic pleural hair groups, which, of course, would separate it at once from the *leucosphyrus* subgroup.

Of the Philippine material of this subgroup, the specimens taken on the Island of Luzon come nearest to the type form of *leucosphyrus*, except perhaps for the reduced tarsal banding. The available material and descriptive matter for *leucosphyrus* type and variety *hackeri* are, however, not sufficient to permit a detailed comparison, and the specimens from Luzon are provisionally identified as *leucosphyrus*.

So far as we have been able to make comparisons in the species discussed here, no marked differences have been noted in the characters of the male genitalia.

Summary of Distinguishing Characters.

Adults.

1. White band of hind tibia with a stripe of dark scales on the frontal, or ventral, aspect; presector dark spot of vein 1 uninterrupted with white and no longer than the corresponding spots on costa and subcosta; subapical dark spot of vein 1 with one white interruption or none; female palpi as long as proboscis or nearly so; palpal and tarsal banding reduced; both sexes usually with single thoracic propleural hairs 2

   White tibial band entirely encircling segment; presector dark spot of vein 1 with 1 or more white interruptions and usually extending basally into area of presector white spot; subapical dark spot of vein 1 with 2 to 4 white interruptions; prehumeral white spot of costa present; males usually (?) with 2 thoracic propleural hairs on each side (no male specimens of var. *hackeri* available) 3

[7] *Op. cit.*, p. 191.

2. Costal prehumeral white spot absent, or rarely present on one wing; first mid-tarsal segment unspeckled or with few spots ..... *A. cristatus*, sp. n.

Costal prehumeral white spot present; first mid-tarsal segment usually well speckled ..... *A. leucosphyrus riparis*, var. n.

3. Female palpi as long or nearly as long as proboscis; well-marked palpal and tarsal banding on type form (tarsal banding reduced on Luzon specimens) ..... *A. leucosphyrus*

Female palpi much shorter than proboscis; narrow palpal and tarsal bands. (The published descriptions of this variety are incomplete) *A. leucosphyrus* var. *hackeri*

Larvae.

1. Large, strongly branched postclypeal hairs, reaching well beyond front of clypeus; anterior clypeal hairs rather strongly branched or frayed; palmate hair of second abdominal segment well developed; thoracic palmate hair partially developed; basal tubercles of shoulder hairs not fused; teeth of pecten mostly subequal in length ..... *A. cristatus*

Postclypeal hairs either much shorter or unbranched; anterior clypeal hairs simple or weakly frayed; thoracic palmate hair not developed; basal tubercles of shoulder hairs frequently or usually fused 2

2. Palmate hairs of second abdominal segment developed; postclypeal and outer clypeal hairs more than half as long as inner; all clypeal hairs simple ..... *A. leucosphyrus* var. *hackeri*

Palmate hairs of second abdominal segment rudimentary; postclypeal and outer clypeal hairs short, usually simple, sometimes forked, or postclypeal with several slender branches; inner clypeal hairs sparsely frayed; pecten with a few long teeth, the others distinctly shorter ..... *A. leucosphyrus* and *A. leucosphyrus* var. *riparis*

THE APHID GENUS EPAMEIBAPHIS IN UTAH.[1]

By G. F. Knowlton and C. F. Smith.[2]

The genus *Epameibaphis* Oestlund may be characterized as: Vertex nearly flat; secondary sensoria circular; cornicles cylindrical with conspicuous knob-shaped apex; wing venation as in the genus *Aphis;* hairs long, many of thm blunt, enlarged, or flattened at tip. Genotype *Aphis frigidae* Oest.
Oestlund, 19th Rpt. State Ent. Minn., pp. 132–133. 1922.

Key to Species.

A. Cornicles black ..... *atricornis*

A.A. Cornicles pale ..... B.

B. Sensoria present upon antennal III in aptera (Fig. 1–J) ..... *frigidae*

B.B. Sensoria absent from antennal III in aptera (Fig. 1–F) *utahensis* n. sp.